

time of Descartes and Leibnitz, when physical science and moral philosophy went hand in hand, to find an equivalent.

But it must be allowed that the science of Thermodynamics may be treated with advantage from this double point of view; for, after its First Law has been established, that heat and work are equivalent and interchangeable, the rate of exchange being fixed by the mechanical equivalent of Joule and Hirn, when we come to the Second Law, named after Carnot, we are compelled to secure conviction of its truth by an appeal to the arguments of analogy and metaphysics.

Hirn spent the last years of his life at Colmar, in the society of a few congenial friends, much interested in metaphysics and meteorology, but cut off from his native France by international strained relations.

In this age of practical Thermodynamics his work will not be lost sight of; but we are still far from a complete reconciliation of the abstract theories of the books and the observed realities of practice.

A. G. GREENHILL.

NOTES.

THE Croonian Lecture, which will be delivered before the Royal Society on February 27 by Prof. Marshall Ward, will be on "The Relations between Host and Parasite in certain Epidemic Diseases of Plants."

ON Thursday last the Astronomer-Royal was elected by ballot to fill the place of the late Father Perry upon the Council of the Royal Society.

METEOROLOGISTS will be sorry to hear of the death of Prof. C. H. D. Buys-Ballot, on Sunday last. He was born in 1817, and had been Director of the Meteorological Institute, Utrecht, for more than 30 years.

DR. DAVID SHARP, the eminent entomologist, and late President of the Entomological Society of London, has accepted the appointment of Curator in Zoology in the Museum of the University of Cambridge, rendered vacant by the resignation of the Rev. A. H. Cooke, whose labours on the Macandrew Collection in that Museum have been so highly appreciated by conchologists.

SIR WILLIAM GULL, F.R.S., was so distinguished a physician, and his name was so well known, that the tidings of his death excited a widespread feeling of regret. He died on Wednesday, January 29, from paralysis, and the funeral took place on Monday at the churchyard of Thorpe-le-Soken, Essex. He was in his seventy-fifth year.

WE regret to hear of the death of Dr. L. Taczanowski, which took place at Warsaw on January 11. He is best known for his standard work "Ornithologie du Pérou," but his contributions to the ornithology of Poland, of Siberia, and the Corea have also been numerous and important.

GERMAN papers announce the death of Otto Rosenberger, the well-known astronomer. He was born in Courland in 1810, and in 1831 was appointed to the charge of the Observatory at Halle, and at the same time was made Professor of Mathematics. This position he held during the rest of his long life. Rosenberger's name is known chiefly in association with his work relating to Halley's comet.

ANOTHER death which we are sorry to have to record is that of Prof. Neumayr, the geologist, of Vienna. He was only a little over forty years of age, and his death is a great loss.

ON February 15, Lord Rayleigh will begin a course of seven lectures at the Royal Institution. The subject will be electricity and magnetism.

THE Council of the Society of Arts have arranged that a course of lectures on "The Atmosphere" shall be given by Prof. V. Lewes on the following Saturday afternoons: March 8, 15, 22, and 29, at 3 o'clock.

MR. B. A. GOULD, Cambridge, Mass., has been appointed President of the American Metrological Society for the present year. Among the members of the Council of this Society are Messrs. Cleveland Abbe, H. A. Newton, Simon Newcomb, and S. P. Langley. The Society was founded in 1873, and its objects are to improve existing systems of weights, measures, and moneys, and to bring them into relations of simple commensurability with each other; to secure the universal adoption of common units of measure for quantities in physical observation or investigation, for which ordinary systems of metrology do not provide; to secure uniform usage as to standard points of reference, or physical conditions to which observations must be reduced for purposes of comparison; and to secure the use of the decimal system for denominations of weight, measure, and money derived from unit-bases, not necessarily excluding for practical purposes binary or other convenient divisions.

THE Committee of the Cambridge University Antiquarian Society in their fifth Annual Report state that, since the opening of the Archæological Museum in 1884, over 2800 objects and 900 books have been added to the collection. The most important additions have been made in the ethnological department, including (during the past year) General Scratchley's collections from New Guinea, a series of 500 specimens of implements and ornaments from the West Indies, presented by Colonel Fielden, who has also given many rare stone implements and weapons collected in South Africa, and a series of 70 specimens of dresses, weapons, &c., from the Solomon and Banks Islands and from Santa Cruz, presented by Bishop Selwyn. The Curator, Baron von Hügel, reports that during the long vacation he excavated with success a Roman refuse-pit and a burial-place at the eastern side of Alderney. The digging is to be resumed.

THE seventh annual dinner of the Association of Public Sanitary Inspectors was held on Saturday evening at the First Avenue Hotel, Holborn. Dr. B. W. Richardson presided, and proposed the toast of "The Association and its President, Sir Edwin Chadwick." The duties of the Association, he said, were to teach and protect its members, and all sanitary inspectors ought to belong to it. He hoped that the apathy at present shown by too many of them would not last any longer.

DR. A. N. BERLESE, of Padua, has been appointed Professor of Botany to the Royal Lyceum at Ascoli-Piceno; and Dr. J. H. Wakker, of Utrecht, Professor of Botany at the dairy school at Oudshoorn, Holland.

THE *Botanical Gazette* published at Crawfordsville, Indiana, gives some particulars of one of the most magnificent bequests ever made for scientific purposes, that of the late Mr. H. Shaw for the endowment of the Botanic Garden and School of Botany at St. Louis, Missouri, amounting to not less than between three and five million dollars. The trustees have determined to apply the income to the maintenance and increase in the scientific usefulness of the Botanic Garden; to provide fire-proof quarters for the invaluable herbarium of the late Dr. George Engelmann, and to supply means for its enlargement; to secure a botanical museum; and to gradually acquire and utilize facilities for research in vegetable physiology and histology, the diseases and injuries of plants, and other branches of botany and horticulture. To aid in the carrying out of this last purpose, travelling botanical scholarships have been established. The present very able director of the Botanic Garden is Dr. William Trelease.

THE *Kew Bulletin* for February begins with some extracts from the Annual Report on the Government cinchona plantation and factory in Bengal for the year 1888-89. The valuable information presented in these extracts is given for the benefit of persons growing cinchona in countries which the documents for the Government of Bengal are little likely to reach. The new number also deals with the use of maqui berries for the colouring of wine, vine-culture in Tunis, phylloxera in Victoria, the botanical exploration of Cuba, and the sugar production of the world. The section on the last of these subjects relates to statistics brought together in Dr. Robert Giffen's report on the progress of the sugar trade. Commenting on the figures supplied in this report, the writer in the *Bulletin* says that if they "do not justify a gloomy view of the present position of the cane-sugar industry in British colonies, they scarcely justify a very optimistic one. It is obvious that the capital which should be applied to the improvement of manufacturing processes and machinery is, under present circumstances, practically diverted to the mere maintenance of the cultivation. And this in the long run must be a losing game. At present the fact stands that West Indian sugar has to a large extent been driven from the home market to that of the United States. If in time it should lose that, its fate apparently is sealed."

AT the last meeting of the Paris Biological Society, Prof. Raphael Blanchard gave an interesting account of a peculiar pigment, hitherto found in plants only, *carotine*, which he has discovered in a crustacean in one of the Alpine lakes, near Briançon. Its functions are not yet known, but M. Blanchard intends to pursue his study of the subject on the spot. The animals cannot be transported alive to lower levels.

WE are glad to welcome the first number of *The University Extension Journal*. The Society by which it is issued has become important enough to need an organ of its own; and the new periodical, which will appear at the beginning of every month, ought to be of service to all who are in any way interested in the movement.

THE *Engineer* of January 31 contains a leading article on "Colour-blind Engine-drivers," and it is interesting to note what the leading technical journal has to say on the subject: "We do not say that no accident was ever brought about by the inability of a driver to distinguish between a green light and a red one, but we can say that nothing of such an accident is to be met with in the Board of Trade Reports." Our contemporary is of opinion that the testing of the sight of locomotive men should be made under working conditions, *i.e.* with actual signal lights.

A PAPER on mortality from snake-bite in the district of Ratnagerry was read lately before the Bombay Natural History Society by Mr. Vidal, of the Bombay Civil Service. Many of the deaths in that district are, he says, due to a small and insignificant-looking snake, called "foorsa" by the natives. It is a viper rarely more than a foot long, and is so sluggish that it does not move out of the way till trodden on. Thus it is much more dangerous than the stronger and fiercer cobra.

DURING the year 1889 no fewer than 28 bears, 115 wolves, and 45 wolf-cubs were shot in the single district of Travnik, in Bosnia.

Das Wetter for January contains:—(a) An article by Dr. R. Assmann on climatological considerations about the prevalent epidemic of influenza. From an experience of many years in dealing with the connection between climatic conditions and the state of health, the author gives the following conditions as the most favourable for spreading organisms in the air: (1) dry-

ness of the soil, (2) deficiency of snow covering, (3) deficiency of rainfall, (4) existence of fog or low-hanging clouds, (5) prevalence of high barometer with a small intermingling of air in the vertical direction; and he shows that these conditions were prevalent in Eastern and Central Europe from the beginning of November; that atmospheric dust existed in great quantities, and was propagated westward by easterly, north-easterly, and south-easterly winds. He considers that changes of temperature had no important relation to the spread of the epidemic. (b) A lecture recently delivered to the Scientific Club in Vienna, on the general circulation of the atmosphere, by Dr. J. M. Penner. He refers to the idea of the conflict of polar and equatorial winds so long supported by Dove and others, and shows that the publication of synoptic charts since the year 1863 has demonstrated that the above theory does not hold good for temperate and northern latitudes, that the circulation there depends upon the positions of the areas of high and low pressures, producing cyclones and anticyclones. Many dark points require explanation, such as the tracks which the cyclones follow, but much new light has recently been thrown upon the subject, especially by the researches of Ferrel, Oberbeck, and Abercromby.

DR. ALBRECHT PENCK, Professor of Physical Geography at the University of Vienna, lately called attention to the fact that no two official accounts of the area of the Austro-Hungarian monarchy agree. The difference between the highest and the lowest estimates amounts to 3313'75 square kilometres. By an examination of the new special map constructed by the Army Geographical Institute, which is on the scale of 1 to 75,000, and occupies 400 sheets, Prof. Penck has satisfied himself that the actual area of the Empire is 3247'12 square kilometres greater than is given in the latest published official account. The error arose chiefly from an incorrect triangulation of the Hungarian portion of the Empire, which is 3054'02 square kilometres larger than has been supposed.

It has hitherto been generally believed that the Montgolfier or hot-air balloon cannot be used in tropical climates. If this were true, ballooning for war purposes would of course be impossible in places where coal-gas could not be obtained. We learn from the *Times* that Mr. Percival Spencer, who has been making a series of interesting balloon experiments in Central India, has succeeded in showing that the theory is without foundation. At Secunderabad, in presence of the garrison and a crowd of European and native spectators, he lately made an ascent in his patent asbestos balloon. The inflation was effected by the burning of methylated spirit inside the balloon, which was held in place by 25 soldiers of the Bedford regiment until the word to "let go" was given. After rising to a considerable height, the aeronaut descended by means of his parachute. The spot where the ascent was made is over 2000 feet above the level of the sea, and the achievement was all the more remarkable because of the sultry climate and the great rarity of the air.

AN interesting paper on "Some Terraced Hill Slopes of the Midlands," by Mr. Edwin A. Walford, has been reprinted from the *Journal of the Northamptonshire Natural History Society*. The factors in the formation of these terraced slopes Mr. Walford groups as follows:—(1) The slipping and sliding outwards of the saturated porous marls upon the tenacious clays at the line of drainage, aided doubtless by the pressure of the superincumbent rock bed. (2) Displacements caused by the removal by chemical and mechanical solution of certain constituents of the marls and marlstone by the passage of the surface water through them. (3) The sliding downwards of the surface soil, as described by Dr. Darwin, and latterly illustrated by Mr. A. Ernst. The suggestions offered by Mr. Walford agree in the main, as he himself points out, with those adopted by Mr. A. Ernst in his paper in *NATURE*, February 28, 1889.

MESSRS. GAUTHIER-VILLARS (Paris) have recently added three new works to their already large list of photographic treatises. One is the "Manuel de Phototypie," by M. Bonnet, giving full details of the various processes for the rapid reproduction of photographs, such as is now demanded for many purposes. The formulæ are stated very clearly, and the apparatus required is sufficiently illustrated by diagrams. The treatise is thoroughly practical, and will be very valuable to all interested in the subject, whether as amateurs or for trade purposes. The second—"Temps de Pose"—is by M. Pluvinel, and deals with the difficult question of the time of exposure. It is shown that what is generally regarded as a rule-of-thumb process can be reduced to a scientific one. The various functions of the duration of the exposure are first considered mathematically, and it is then shown how the results of the investigations are to be applied practically, the method being illustrated by worked-out examples. To simplify matters, tables are given showing the different elements, such as coefficient of brightness, for all ordinary photographic subjects. The treatise is chiefly interesting as a scientific contribution, as few photographers will care to take the trouble of working out the time of exposure, now that they have found that good work can be done by judgment alone. The third book is in two volumes, and treats of the various "film" processes ("Procédés Pelliculaires," by George Balagny). It claims to give a full account of all that has been said and done in connection with the subject since the introduction of photography, and as far as we can judge, this claim is fully justified. Every detail of the subject is considered in a very practical manner. One of the most interesting applications of flexible films mentioned is the registration of flash signals in "optical telegraphy."

THE "Year-book of Photography" (Piper and Castle) for 1890 fully bears out the good reputation gained by its predecessors. In addition to the information relating to the various photographic societies, there are several articles on the advances in photographic processes which have been made during the past year, and other useful notes. One of the most interesting articles is that by the editor on photography in natural colours, from which we learn that "processes of practical value, to achieve the end, are likely to be discovered by the exercise of ability and perseverance." The only important omission we notice is a record of the remarkable achievements in astronomical photography. The volume contains a portrait and short biographical notice of Edmond Becquerel. The whole forms an invaluable book of reference to all photographic matters, with the exception referred to.

MESSRS. GEORGE BELL AND SONS have published "The School Calendar and Hand-book of Examinations, Scholarships, and Exhibitions, 1890." This is the fourth year of issue, and great pains have been taken, as in former years, to secure that the information brought together shall be full and trustworthy. A preface is contributed by Mr. F. Storr.

THE sixteenth part of Cassell's "New Popular Educator" has been issued. It includes a map of Australasia.

THE Proceedings of the International Zoological Congress, held in Paris last summer, will be ready for distribution in a fortnight.

A NEW and very simple method of synthesizing indigo has been discovered by Dr. Flimm, of Darmstadt (*Ber. deut. chem. Ges.*, No. 1, 1890, p. 57). In studying the action of caustic alkalies upon the monobromine derivative of acetanilide, $C_6H_5.NH.CO.CH_2Br$, a solid melting at $131^{\circ}5$, it was found that when this substance was fused with caustic potash a product was obtained which at once gave an indigo blue colour on the addition of water, and quite a considerable quantity of a blue solid resembling indigo separated out. The best mode of carrying out the operation is described by Dr. Flimm as follows:—The

monobromacetanilide is carefully mixed with dry caustic potash in a mortar, and the mixture introduced into a retort and heated rapidly until a homogeneous reddish-brown melt is obtained. This is subsequently dissolved in water, and a little ammonia or ammonium chloride solution added, when the liquid immediately becomes coloured green, which colour rapidly changes into a dark blue, and in a short time the blue colouring matter is for the most part deposited upon the bottom of the vessel in which the operation is performed. The fused mass may also conveniently be dissolved in dilute hydrochloric acid, and a little ferric chloride added, when the formation of indigo takes place immediately. The collected blue colouring matter may be readily obtained pure by washing first with dilute hydrochloric acid and afterwards with alcohol. That this blue substance was really common indigo was proved by the fact that it yielded several of the most characteristic reactions of indigotin, such as solubility in aniline, paraffin, and chloroform, its sublimation, and the formation of sulphonic acids, which gave similar changes of colour with nitric acid to those of indigotin. The final proof was afforded by its reduction to indigo white and re-oxidation to indigo blue by exposure to air. Moreover, the absorption spectrum of the colouring matter was found to be identical with the well-known absorption spectrum of indigo. Hence there can be no doubt that indigo is really formed by this very simple process. The chemical changes occurring in the reaction are considered by Dr. Flimm to be the following:—Indigo blue is not produced directly, but first, as a condensation product of the

monobromacetanilide, indoxyl is formed, $C_6H_4 \begin{smallmatrix} \text{NH} \\ \diagup \quad \diagdown \\ \text{CO} \end{smallmatrix} \text{CH}$, or

more probably a pseudo-indoxyl of the isomeric constitution

$C_6H_4 \begin{smallmatrix} \text{NH} \\ \diagup \quad \diagdown \\ \text{CO} \end{smallmatrix} \text{CH}_2$. This intermediate substance then passes over

by oxidation into indigo, $C_6H_4 \begin{smallmatrix} \text{NH} \\ \diagup \quad \diagdown \\ \text{CO} \end{smallmatrix} \text{C}=\text{C} \begin{smallmatrix} \text{NH} \\ \diagup \quad \diagdown \\ \text{CO} \end{smallmatrix} C_6H_4$,

two molecules each losing two atoms of hydrogen by oxidation, and then condensing to form indigo. It was not found possible to isolate the intermediate pseudo-indoxyl, owing to its extreme instability; indeed, the all-important point to be observed in the practical carrying out of the synthesis by this method is that the fusion must be performed quickly and the temperature raised rapidly to a considerable height, the whole process occupying only a few minutes. The yield of pure indigo under the conditions yet investigated is not very large, amounting to about four per cent. of the weight of the original anilide.

THE additions to the Zoological Society's Gardens during the past week include thirteen Cuning's Octodons (*Octodon cuningi*) from Chili, presented by Mr. W. H. Newman; five Common Dormice (*Muscardinus avellanarius*), British, presented by Mr. Florence Wyndham; a Large Hill-Mynah (*Gracula intermedia*) from India, deposited; a Dingo (*Canis dingo*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on February 6 = 7h. 7m. 56s.

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(2) 51 Geminorum ...	5.5	Yellowish-red.	7 7 3	+16 21
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(5) DM. + 3 ^h 13 ^m 31 ^s ...	9	Reddish-yellow.	6 38 54	+ 3 24
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